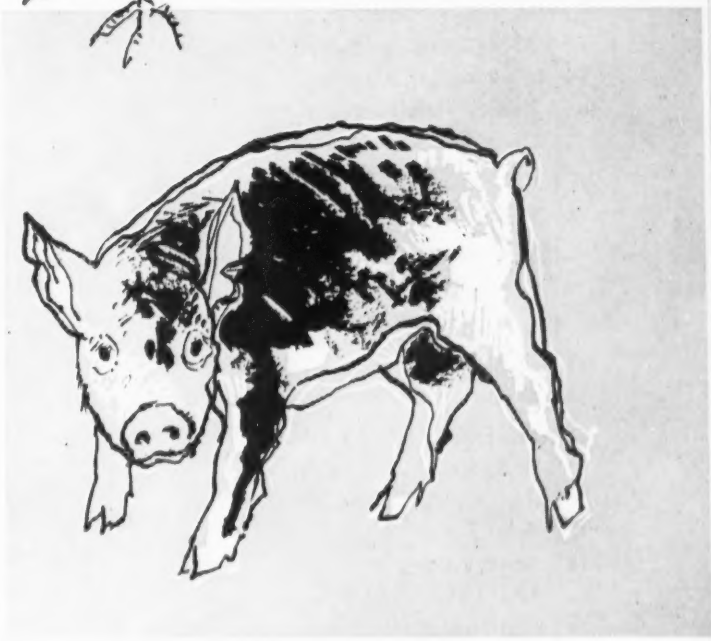
AGRICULTURAL Research

August/1960

U.S. Department of Agriculture



AGRICULTURAL Research

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Editor: J. F. Silbaugh. Managing Editor: H. G. Hass. Contributors to this issue: M. S. Peter, J. R. Madison, E. Evers, C. E. Olsson, J. R. Deatherage.

Enough?

Can the people of the world be fed?

There's reason to believe that the job could be done at present by applying the science and technology at hand to the lands already under cultivation around the globe.

We know that improved farming techniques can increase production enormously. The possibilities are apparent when we look at the wide variations that still exist in production levels in different areas of the world. For example, the yield of wheat in Denmark in 1957 was nearly four times the world average, six times that of India, more than eight times that of Africa, and twice the yield of wheat in the United States.

The world could actually feed a great many more people than exist on the earth today by bringing new land under cultivation. Scientists estimate that additional acreage totaling three times the area we now farm could be added.

But with the world's population increasing the way it is, we may eventually need to use every available acre—*and* work it so as to attain its full food-growing potential.

This food will be produced on millions of *individual* farms—each different in some way or other. To each farmer's experiences and traditions must be added knowledge and methods developed by other people and adapted to his own farm.

The point is that farmers progress in an orderly and effective way only when they have advisory services that are based on knowledge of *scientific principles* combined with knowledge of *local conditions*. Basic information can be transferred from one country to another, but its application varies widely with the different kinds of soil and the crops grown in each country. There must be scientists available with the competence to understand the basic principles and interpret them for technicians who work directly with farmers.

This calls for effective research within each country. Although many agricultural research centers around the world are making important contributions, facilities and personnel are short in most of the underdeveloped countries.

A well-rounded research effort affords our greatest hope for eliminating hunger throughout the world.

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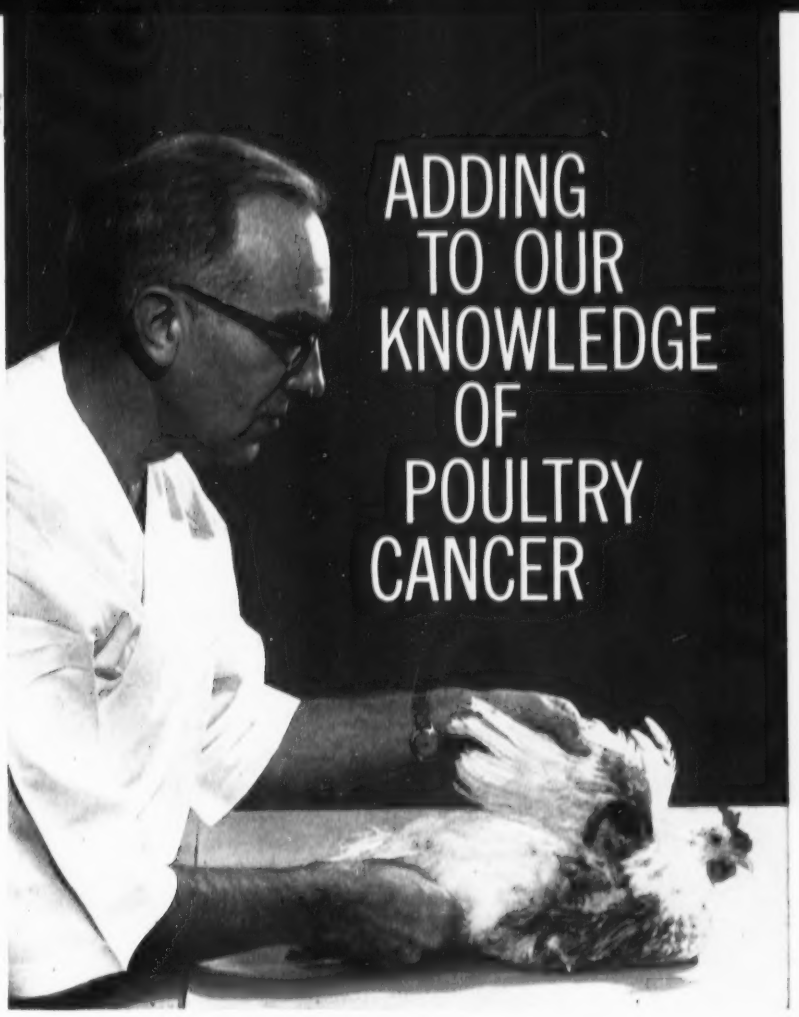
AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

ADDING TO OUR KNOWLEDGE OF POULTRY CANCER



B. R. Burmester examines bird infected with Rous sarcoma. Viruses causing various neoplasms of fowl are similar and closely related antigenically.

Behavior of some tumorous growths in poultry may be of interest in other types of cancer research

■ One form of a poultry cancer long considered not contagious was shown for the first time in recent work to be transmitted by contact.

Overwhelming evidence has come out of two trials at the USDA Regional Poultry Research Laboratory, East Lansing, Mich., showing that the virus of Rous sarcoma was transmitted to healthy chickens when raised in direct contact with birds inoculated with the virus.

Tumors in the birds infected by contact were microscopically and pathologically the same as tumors in birds that were inoculated with the virus. Variations in virus content found in several types of tumors from contact-infected birds were apparently related to the size and type of tumor. Virus taken from the tumors of contact-infected birds was capable in most instances of infecting healthy birds and was proven by immunological tests to be the same virus as that used to inoculate the chickens that served as the source of exposure.

The work by ARS biologist B. R. Burmester has provided us with important additions to growing knowledge on the behavior of poultry cancers, and may be of interest in other types of cancer research.

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Adding To Our Knowledge Of POULTRY CANCER

(*Continued*)

The studies have established a little more firmly the belief of many scientists that viruses cause some forms of animal and human cancer. And by showing the contagious nature of one of these viruses, it's now possible to speculate on whether or not similar virus-caused cancers may be contagious, too. This—along with work elsewhere—suggests a reversal of the long-held belief that a disease either *is* or *is not* contagious. The contagiousness of a virus-caused disease may depend largely upon the virulence of the virus and susceptibility of the host.

All chickens in the tests were raised in special solid-walled cubicles, on wire-mesh floors raised a foot above the concrete floor of the pen. Birds were inoculated either subcutaneously or intravenously with varying amounts of the Rous sarcoma virus.

In one test, 45 birds that had not been inoculated were allowed to intermingle in the same cubicle with their inoculated penmates. Thirty-five of the birds raised in direct contact with birds inoculated subcutaneously died of Rous sarcoma. In addition, 6 of 59 chickens reared in direct contact with 113 birds inoculated intravenously with a lower dose of the virus died with tumors.

No indirect transfer of virus

In another test, 23 birds in direct contact with 58 inoculated subcutaneously died with tumors, and 3 of 57 in direct contact with birds inoculated intravenously with a lower dose died with tumors.

None of the birds placed in *indirect* contact with inoculated birds died with tumors. (These chickens were put in the same cubicles with their inoculated penmates, but were separated by a wire-mesh screen.)

The visible tumors in the contact-infected birds were located in nearly all parts of the body. Almost half the birds had large tumors only in the viscera—primarily the lungs, mesenteries, spleens, livers, and kidneys. Fastest growing tumors were soft, hemorrhagic, and ulcerated.

Transmissibility of two types of tumors from contact-infected chickens was tested. Young chickens were inoculated subcutaneously with viral extracts made from large, hemorrhagic tumors, or small, firm, solid ones. Eighteen of 20 birds inoculated with extract of the large tumor developed tumors and 14 died. Extract of the small tumor caused tumorous growths in only 8 of 20 chickens.

Contact infection slow acting

A large dose of the virus injected subcutaneously produced many more cases of Rous sarcoma in the directly exposed birds than a smaller dose given intravenously. In addition, it took much longer for tumors to develop and for death to occur in the contact-infected birds than in the inoculated birds. First tumor deaths in contact-infected birds occurred 37 days after penmates were inoculated, compared with 14 days in the inoculated chicks. Burmester believes it likely that the virus must propagate in the inoculated birds and reach some as yet undetermined level before contact transmission occurs.

This tends to confirm findings of others that concentration of virus in a tumor is directly proportional to inoculating dose. For example, birds exposed to penmates given a *low* virus dose developed tumors at a slower rate than birds exposed to penmates inoculated with a *large* virus dose. Moreover, fewer contact chickens developed tumors in this test.

Burmester emphasizes that no attempt was made to detect any inapparent infection which may have been present in the chickens. Also, the highly inbred line of chickens in these studies are known to be susceptible to the Rous sarcoma virus.

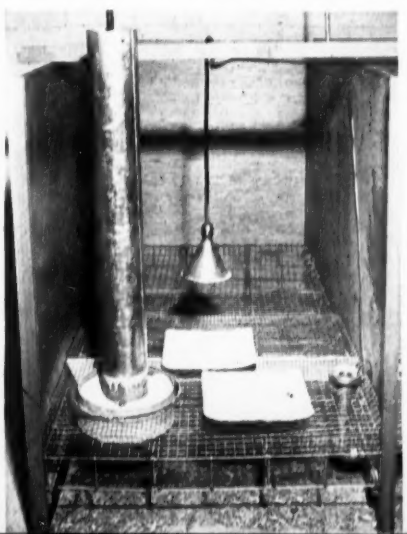
Virus may enter through skin

Studies on the possible modes of transmission of the Rous sarcoma or Rous-like viruses have been limited. But this work did show that the virus can easily gain entrance through a feather follicle and cause local as well as visceral tumors.

Intranasal instillation of the virus caused tumors in more than half the birds. No tumors resulted when chickens were confined to a small enclosure and made to breathe a high virus dose in aerosol form for 5 minutes every other day for 5 days.

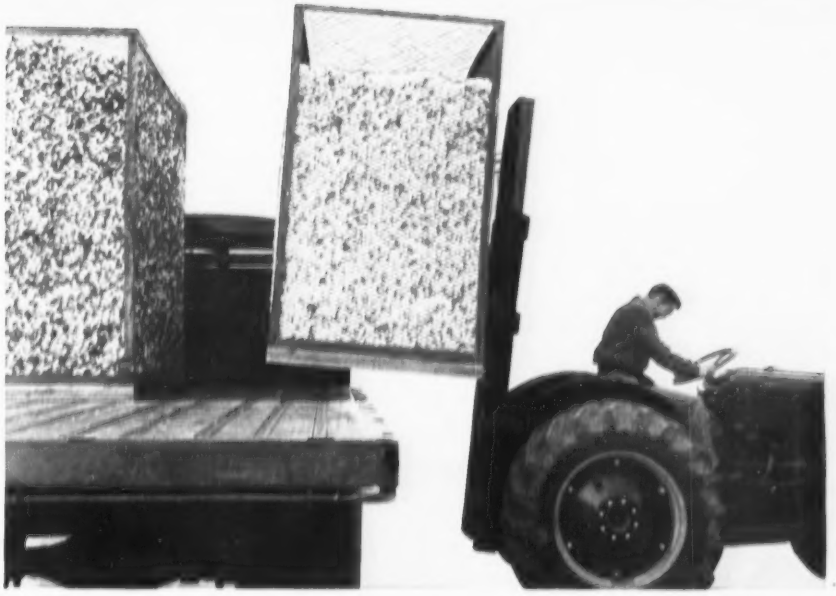
No tumors resulted from a small amount of the virus placed under the tongue or applied to a nonfeathered area of intact skin. But when the virus was applied to skin that had been scratched with a hypodermic needle, or to an area where immature feathers had been extracted, tumors occurred in 30 percent of the chickens.☆

Special solid-walled cubicles housed chickens during tests. Birds intermingled freely.



Agricultural engineers developed a basket-like container that increases efficiency because it's

A COTTON HARVEST TIMESAVER



A fork-lift hoist on a tractor easily moves a container filled with cotton.

■ Farmers no longer have to wait hours for seed cotton to be processed at the gin. They can leave promptly after delivering the cotton in newly developed one-bale containers.

Designed for construction on the farm, these basketlike containers also allow harvesting to proceed independently of ginning.

One- or two-bale lots of seed cotton usually are loaded loosely into a pickup truck, trailer, or wagon and delivered to the gin. Each farmer must wait until his cotton is unloaded before leaving for a second load. During the season's peak, growers often are in line 6 to 8 hours a day—at a critical time when they are needed in the field. Increased use of mechanical harvesters is adding to gin congestion.

Alternatives cost too much for profitable use

Farmers' usual alternatives—buildings for temporary storage or extra trucks—are too expensive for profitable use under normal conditions. Fixed storage space at gins or extra equipment for immediate processing of the cotton adds much to costs.

The containers were devised by agricultural engineers of USDA's Southeastern Cotton Ginning Research Laboratory and the South Carolina Agricultural Experiment Station, both at Clemson. The originators of this idea are J. B. Cocke and J. A. Luscombe of ARS, J. H. Anderson of the station, and T. P. Reid, former research assistant there.

Enough seed cotton for a uniform 500-pound bale can be loaded into each 4- x 6- x 7-foot container, without excessive tramping or loss of quality. No quality is lost if regular conveyances are used, but it's often hard to divide large loads into uniform-size bales.

Containers of seed cotton (of less than 12 percent moisture) need not be processed immediately. Thus, a backlog can be ginned at a rate that ensures top-quality lint. If cotton is ginned too fast, in efforts to keep ahead of the harvest, lint quality is lost.

Containers developed should last several years

In tests, the strongest container was built of 1½-inch angle iron framing covered with ¾-inch expanded metal. A less expensive container was made of 2- x 4-inch lumber framing covered with ¾-inch hardware cloth or chicken wire. It can be built by unskilled labor and either type should last several years.

Two men can lift an empty container onto a truck. A fork-lift hoist, such as can be inexpensively mounted on a tractor, is needed to move the filled containers.

Farmers could make good use of a lift mechanism mounted on the transporting vehicle, the agricultural engineers suggest. Instead of being kept in the field while cotton is picked, the vehicle could be carrying filled containers to the gin. Deliveries could be made after harvest each day or before field work starts.

The containers are already being used at the ginning laboratory, where plans are available for making the angle-iron device. Plans for the wooden container may be obtained from the South Carolina station.☆

Heat changes starch granules, indicates cohesiveness

NEW TEST REVEALS RICE COOKING QUALITY

■ An improved method for determining the cooking quality of new rice varieties has been developed by USDA researchers. Only a few kernels are required for the test—important when the available quantity of a variety or particular hybrid is small.

With this method (based on heat-caused changes in starch granules), scientists can predict tendency of rice kernels to stick to each other when cooked. Cohesiveness is an important quality for some purposes and some tastes; for others, separateness of grains is preferred.

Test can aid in rice breeding

Rice breeders and growers need to know how a new variety will cook so they can select for further development the ones that will better meet the various needs of processors and the tastes of consumers.

Rice varieties that show greatest change in starch also tend to rate as most cohesive in taste panel scores. The starch that changes most at the test temperature gelatinizes at a low temperature.

For testing, rice samples are milled, pulverized, heated in water at 62° C. (144° F.) for 30 minutes, and examined under a phase-contrast microscope (specially lighted to show transparent objects).

This method grew out of work on the structure of rice grains and their reaction to chemicals, under direction of food specialist Elsie H. Dawson in the ARS Institute of Home Economics. Standardized methods of cooking rice for taste panel tests (AGR. RES., August 1957, p. 3) were developed in earlier studies.

For the few varieties whose heat alteration values did not agree with taste panel scores for cohesiveness, treatment with a Millon-type chemical (a protein reagent) provided an index of cohesiveness.

Anatomy explains differences

A study of cell shapes, cell walls, and protein distribution, and how they influence cooking quality also was made by histologist Ruby R. Little. She found that anatomical characteristics help explain some variations in rice processing behavior.

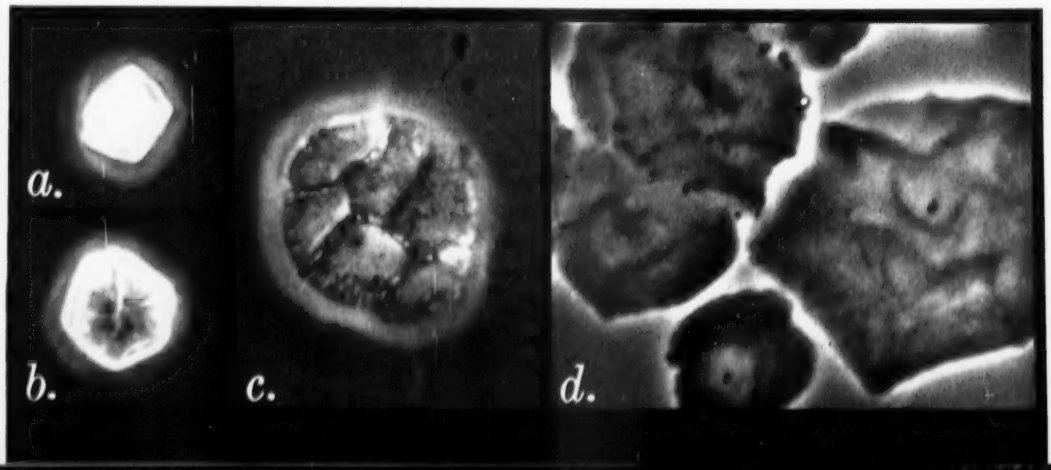
The bran layers of a rice grain include a waxy or corky seed coat, which delays water penetration into and from the interior. This and the thick strong bran walls explain why brown rice takes longer to cook than milled rice from which the bran has been removed. Also, the presence or absence of bran influences the way the kernel will break up in cooking.

In the starchy endosperm, cell walls are thin, fragile, and easily ruptured. Cells differ in size and shape according to variety, but the cell arrangement follows a common pattern in all varieties. A central core of small cells is surrounded by rows of large cells radiating outward and separated from the bran by a few layers of cubical or flattened cells. In some varieties the radiating cells are very long and slender above and below the center.

Granules surrounded by protein

Small clusters of average-size starch granules are densely packed throughout the kernel although in outer cells the granule clusters are smaller and fewer. Each cluster and probably each individual granule is surrounded by protein. Protein lines all cell walls, probably reinforcing them, and is most concentrated in the outer cells. Rice varieties with small cells have more wall area and hence more total protein than varieties with larger cells.

As starch gelatinizes during cook-



Starch granules show varying degree of change when heated 30 minutes. A, unchanged granules are small and bright. B, C, D, altered granules are swollen, darkened, and gelatinized.

ing it expands—causing the kernel to expand and sometimes to break up. Degree and pattern of breakup are influenced by gelatinization temperature of the starch, size and shape of cells in different parts of the kernel, and thickness of the protein encasing the starch. In general, varieties that gelatinize at low temperatures swell and break up more, and become more cohesive than those with high gelatinization temperatures.

Kernels with long, narrow, radiating cells above and below the center may split in half lengthwise during cooking. If outer cells are flattened, outer layers may slough or flake off. In milled rice, kernels first crack lengthwise along the upper side where cell walls are weakest. In brown rice this weak point is protected by an extra thickness of bran, and brown rice cracks at other places, chiefly along the lower side.☆

STARR MILLET FOR SUMMER PASTURE

■ Starr millet is an effective summer supplemental pasture for milk-producing cows, State-USDA studies show. This high-quality forage can carry cows through midsummer, when milk production normally drops.

Studies on Starr and Gahi millets were recently completed at the ARS Dairy Experiment Station, Lewisburg, Tenn., in cooperation with the Tennessee Agricultural Experiment Station, and by State and ARS personnel at the Coastal Plain Research Station, Willard, N.C.

Gahi millet—a popular new hybrid—yields somewhat more *total* forage than Starr. But studies at the North Carolina station showed that Gahi was stemmier and would probably show a greater yield advantage if ensiled rather than grazed. Moreover, forage distribution *during* the season is just as important as total productivity. Starr yields more evenly and recovers better, and peaks come later in the season rather than during the first 2 weeks as with Gahi. This means dairymen using Starr could stock heavier and carry herds longer.

Several perennial pasture species have been used in the past for midsummer grazing. But seldom have any of them been good enough to carry high-producing cows at a desired production level. Summer annuals such as Sudangrass have been widely urged, especially in the sandy Coastal Plain areas. Increasing interest is being shown in millet, however, because it's well adapted to the Coastal Plain area, free of prussic acid, and outyields the best varieties of Sudangrass.

Lewisburg studies compared millets for grazing

Studies at Lewisburg were conducted to find which of the millets provided the best pasture. High-producing Jerseys were put in paddocks—seeded at intervals to each grass—and grazed in rotation. This provided constant access to excellent pasture.

After the cows were rotated, "cleanup" cows were put in to eat remaining forage and provide data on total carrying capacity of the crops.

Starr millet provided a total of 793 grazing days or 132 days per acre, while Gahi produced 752 grazing days or 125 days per acre.

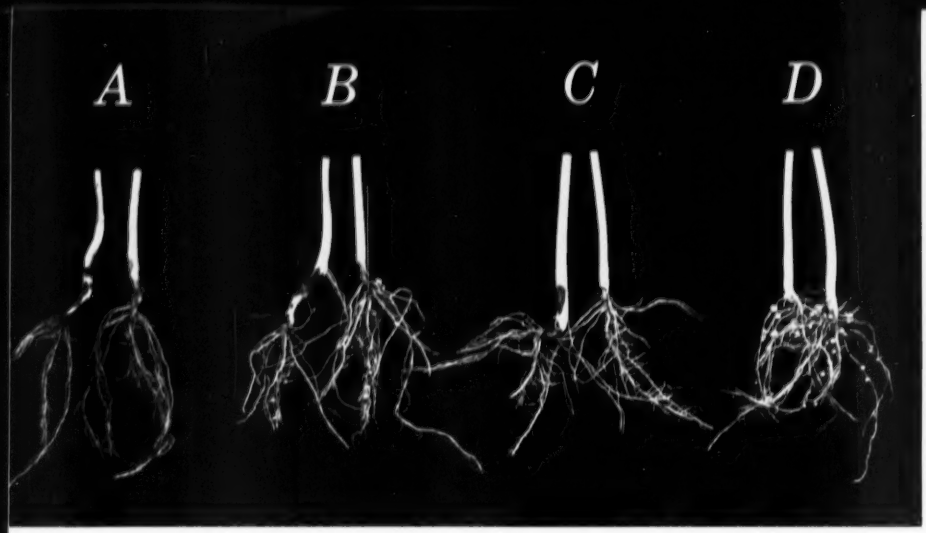
Cows on Starr millet produced 11,694 pounds of milk during the grazing—an average of 35.1 pounds per day. Those on Gahi produced 11,589 pounds of milk—an average of 34.5 pounds per day. When these figures are converted to 4 percent fat-corrected milk, average production was 38.8 pounds per day for animals on Starr millet and 37.3 for those on Gahi. (The amount of butterfat determines to a large extent the energy content of milk; hence, conversion of milk to a standard butterfat content gives a better basis for comparing yields.)

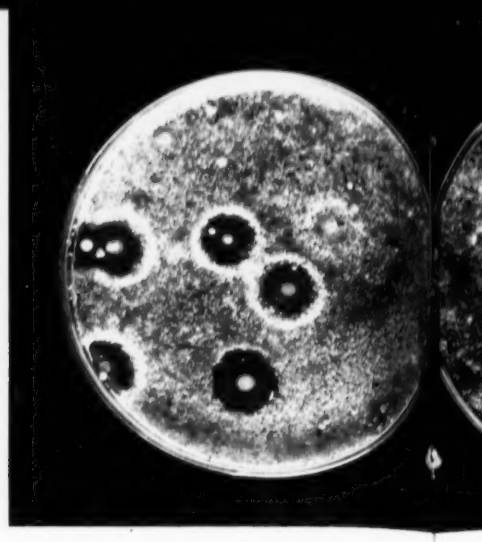
Cows gained weight on Starr, lost on Gahi

The animals grazing Starr millet gained a total of 212 pounds, while those grazing Gahi lost a total of 176 pounds. Although there was little difference in milk production between the two groups of cows, those on Gahi apparently maintained their milk production at the expense of body flesh.

Cows grazing Starr averaged 12.9 pounds of total digestible nutrients (TDN) per day from pasture, or 58.3 percent of their daily needs. Cows on Gahi received an average of 8.57 pounds TDN per day from pasture, or 43.6 percent of their daily needs. The fact that all cows on Gahi lost weight reflects this large difference in daily TDN intake from pasture.

The two crops differed sharply in appearance. Gahi plants were coarse and upright, while Starr plants were finer stemmed and leafy. Cows ate the entire Starr plant to the ground, but tended to strip blades from the Gahi plants and leave stalks standing. This difference in grazing habits may create a problem in managing Gahi pastures. Standing stems could easily give dairymen a false impression of the amount of growth, and cows could be left in the pasture some time after the palatable part of the forage has been exhausted.☆





Diseased roots are from unamended soil (A) and soil amended with oak sawdust (B), mature Sudangrass (C) 4 weeks before planting. Mature barley straw amendment (D) suppressed Rhizoctonia, *allowed better nodule development.*

BIOLOGICAL CONTROL OF SOILBORNE PLANT DISEASES?

Basic studies are helping us understand how antagonists and parasites may help control soil-living fungi and bacteria

■ Soil-living fungi and bacteria that cause root rots, stem rots, and seedling blights of crop plants are hard to get at. There are few economical chemical methods of control, and resistant plants aren't available in many cases. Crop rotation and diversification are about the only defenses at present against most soilborne plant diseases.

But USDA scientists are investigating biological control in basic studies at the Agricultural Research Center, Beltsville, Md.

Biological control often means application of parasites or predators to the environment. This hasn't been practical so far for most soilborne plant diseases. There *are* fungi that parasitize other fungi, but merely adding desirable fungi to the soil seldom establishes them.

A more promising way to change the number and kind of soil organisms is to manipulate the soil's organic content. This method of control, which has been used with some success against a limited number of soilborne diseases, is now under study. Here's the theory behind it:

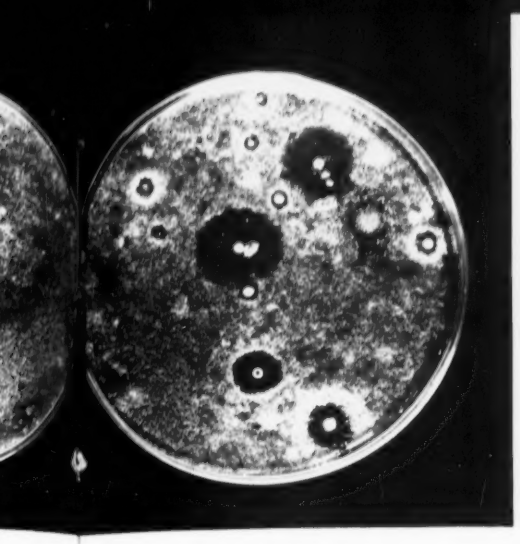
Many plant parasites can exist on nutrient matter in the soil when a susceptible crop is not available. But they must compete for nutrients with other soil organisms. Supplying organic matter which is more favorable for growth of competitive organisms than for the crop parasite would cause a natural decrease in numbers of the crop parasite. Moreover, the organic or nutrient matter might also cause an increase in antagonistic organisms—species that produce antibiotics which inhibit growth of the crop parasite. It is also possible that the numbers of organisms that parasitize crop parasites might be increased.

Adding selected organic matter to soil suppressed certain fungus

But many questions must be answered before this kind of control can be developed precisely. To get at basic answers, ARS soil scientist C. B. Davey and mycologist G. C. Papavizas are experimenting with the fungus *Rhizoctonia solani*, a cause of root rots and seedling blights.

Tests so far have shown *Rhizoctonia* disease *can* be suppressed by adding selected organic matter to the soil. The time of incorporation of the amendment before planting is an important contributing factor.

Mature soybean hay, corn stover, barley straw, and oat straw effectively reduced *Rhizoctonia* disease of snap beans when added to the



Rhizoctonia *grows as white mat in petri dishes except in areas (dark circles) around antibiotic-producing streptomycetes (center). Photomicrograph above shows hypha (actual width=5–10 microns) of* Rhizoctonia *parasitized by tinier hyphae of* Trichoderma viride. *All three cultures are from root area of plants in amended soil.*

soil 4 weeks before planting. Oak sawdust was ineffective. Green amendments gave the best protection against disease when added to the soil 3 to 7 weeks before planting. Of 10 types of green amendment tested, corn and oats were the most effective, Sudangrass was the least effective, and snap beans and buckwheat were intermediate.

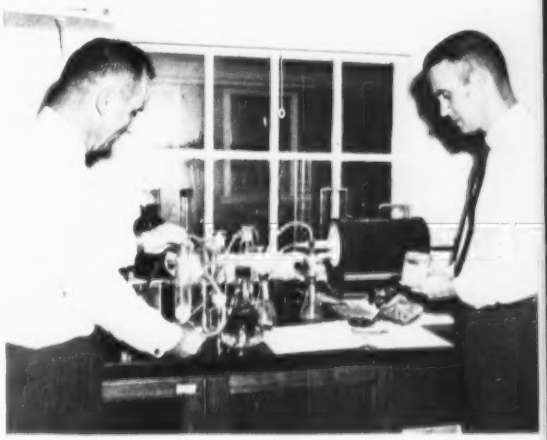
Examination of soil samples showed the reduction in disease incidence in each case corresponded with an increase in numbers of antagonistic streptomycetes. (Streptomycetes, a group between fungi and bacteria, are often producers of antibiotics, e.g., streptomycin, although some species cause such plant diseases as potato scab.) It is not known whether suppression of disease incidence was due to actual death of *Rhizoctonia* or to temporary inactivation.

Amendments more effective when susceptible crop is absent

Other experiments showed the amendments were more effective in suppressing *R. solani* in the *absence* than in the presence of the susceptible crop, through reducing the parasite's ability to compete with other organisms. Thus, it might be possible to develop effective methods to stop *R. solani* before it gets started on a susceptible crop.

The ability of *R. solani* to increase in the presence of competitive organisms was measured through a unique method devised by Papavizas and Davey. Mature stem pieces of buckwheat were buried in soil containing *R. solani* for 4 days. *R. solani* was then isolated from the buckwheat pieces on culture medium. Isolations and counts of *R. solani* and competitive organisms were made 2, 4, 6, and 8 weeks after incorporation of mature soybeans, corn, and oats. This method makes it possible for the first time to check on the infection potential of *R. solani* without use of a susceptible crop, and it gives a more rapid and reliable assay than does disease incidence on susceptible plants.

Davey and Papavizas believe the difference among amendments in preferentially stimulating antagonistic organisms may be partially accounted for by the ratio of carbon to nitrogen in the different plants used. This ratio varies among species and among plants of the same species in different stages of maturity. Mature soybean hay, for instance, contains a higher percentage of carbon than young soybeans.



Papavizas (left) and Davey set up carbon furnace to determine amount of carbon in mature oat straw.

LEAN HOGS from high-fiber, low-energy ration

Efficient and economical gains from diet high in corncob meal

■ Nationwide efforts to slim down overly fat hogs have led us into many lines of genetic and nutritional work to help us do the job effectively. One of the most recent is a USDA-supported study which has shown the usefulness of high-fiber, low-energy diets in producing lean hogs that gain efficiently and economically.

Preliminary results of the first experiment—three more will soon follow—showed that pigs fed corncob meal as the source of fiber did unusually well. If the *level* of fiber in succeeding experiments proves to be more important than the *source*, then rations based on corncobs may be used to improve both carcass quality and economy of production.

These nutritional studies are being conducted by nutritionist J. A. Hoefer of the Michigan Agricultural Experiment Station at East Lansing, under contract with ARS.

Hoefer is trying to develop rations that can produce gains that will go into lean instead of fat tissues. Feed that pigs get is used first for maintenance, then for growth and fattening. Unfortunately, too many pigs produce too much of their weight gains in the form of fat when full-fed. Hoefer's solution is to full-feed pigs on a high-energy ration up to 125 pounds—most weight gains up to this time go into growth—then restrict energy intake by increasing fiber content until market weight.

Fiber sources were compared

In the tests, 42 weanling pigs were full-fed a high-energy basal diet until they reached 125 pounds. The pigs were then divided into six groups. Five of the groups were placed on a diet high in one fiber—barley, oats, wheat bran, alfalfa, or corncob meal. The sixth group was a control group that continued on the same diet as before. All fiber-containing rations were essentially equal in protein, TDN (total digestible nutrients), and fiber content. This allowed for a direct comparison of fiber sources. Pigs were slaughtered when they reached approximately 210 pounds and complete carcass data were obtained.

Corncob ration slightly better

Animals on corncob meal did surprisingly well on all counts. They gained 1.29 pounds daily and averaged 4.30 pounds of feed per pound of gain for a feed cost of $10.15 per 100 pounds of gain.

Most important, these pigs yielded more lean cuts—54.65 percent—than any control or test animals.

The animals fed barley as their fiber source did well, too (although barley is higher in energy than the other fibers). But they yielded only 52.63 percent lean cuts.

The highest gaining pigs were the control animals kept on the high-energy corn diet. Feed costs were up, though, averaging $10.52 per 100 pounds of gain. Yields of lean cuts averaged only 51.20 percent.

More feeding trials planned

Although the tests so far show that corncob meal has promise as an economical and useful source of fiber for hog feeds, Hoefer points out that it's still too early to judge its long-term effectiveness.

These studies—and many others throughout the country—reflect growing consumer interest in lean pork. Producers are interested because they have found that it takes less feed to produce a pound of lean than a pound of fat. Both nutritional and genetic changes will be necessary to bring about the meat-type pig. Although genetic improvements are more permanent, they take longer to produce the desired results. Nutritional changes, on the other hand, produce almost immediate results.☆

BULK HANDLING CUTS MILK PLANT COSTS

■ The lower costs of bulk handling in milk receiving plants make it pay for plants to hasten the transition from can to bulk operation, USDA economist J. B. Roof found in a Farmer Cooperative Service study.

In the bulk-receiving method, one man handles more milk than a 2- or 3-man crew normally does in a can-receiving room. Savings are greater as volume of milk increases, if truck arrivals are spaced properly throughout the day, and if the same man is used in receiving, processing, cleanup, and maintenance.

However, it may take years for all producers supplying a plant to change to bulk handling because of the large investment. In many cases, can-handling plants have added bulk facilities for dual operation.

In this study of 10 milk-receiving plants belonging to a Midwest dairy cooperative, 3 of the plants remained all-can operations during the period studied, 5 became dual can and bulk receiving plants, and 2 completed conversion to all bulk. Records of the actual operations of each plant were analyzed and compared in the study.

As farmers converted to bulk, all-can plants received less milk. Since plant costs could not be reduced, handling costs per hundredweight of milk increased. When plants added bulk facilities with the same volume of milk, costs remained the same. However, per-unit handling costs went down if milk volume increased.

Multiple-plant firms can meet the problem, Roof believes, by converting one or more of their plants to an all-bulk operation and allowing other plants to continue as all-can plants. Savings from all-bulk plants could take care of part or all of the added cost of shipping milk to the consolidated, but necessarily more widely dispersed, can-receiving plants.

To shorten the period of dual operation, single-plant firms may encourage patrons to shift more quickly from cans by offering them premiums for bulk milk. In the long run, the savings from an all-bulk receiving operation may more than offset the cost of premiums.☆

MILESTONE IN BRUCELLOSIS ERADICATION

■ New Hampshire has the distinction of being the first State to be declared brucellosis free by USDA.

Certification was effective April 25, after testing a total of 96,937 animals in all (5,737) herds.

Certification of the State is a major step toward eradication of the disease that is costing livestock producers an estimated $25 million a year. The effectiveness of the campaign against brucellosis in New Hampshire is indicated by the fact that in 1934, when the campaign first started, 49.1 percent of all herds and 10.2 percent of all cattle were infected.

A brucellosis-free certification means all herds were tested within 18 months prior to the date the State is certified, and all herds in which brucellosis was found were retested and found free of the disease. In addition, brucellosis must not be known to exist in any other species of domestic animal.

Before a State can be considered for certification as brucellosis free, it must first be declared a modified-certified area. This means that not more than 1 percent of the cattle nor more than 5 percent of the herds in the State can have brucellosis. New Hampshire achieved the modified-certified status in 1949, the second State to reach that goal.

Although the brucellosis campaign began officially in 1934, major progress was shown after an all-out effort was launched in 1954, backed by sizable State and Federal funds. This reduced the nationwide infection rate by more than half in the past 5 years.

For example, in 1954, only 3 States and 341 counties had attained modified-certified status. In contrast, by the end of May 1960, a total of 24 States plus Puerto Rico and the Virgin Islands had achieved this status. In addition, 1,930 counties out of 3,152 in this country, Puerto Rico, and the Virgin Islands have achieved modified-certified status.

The New Hampshire campaign is headed by P. I. Fitts, State Commissioner of Agriculture; R. W. Smith, State veterinarian; and G. W. Breed, Federal veterinarian.

Progress toward eradication has been made possible by the cooperation of the livestock industry with livestock disease control officials in developing and carrying out an eradication campaign. Key points in the campaign include the blood agglutination test, calfhood vaccination, brucellosis ring test and, more recently, the cull and dry cow test.

Brucellosis is not only one of the Nation's important livestock diseases but it's also a public health hazard. Contact with infected animals or animal products can cause undulant fever in humans.☆

Cow showed desire for one tall fescue (light area) but ignored others, not so palatable, in same pasture.

We've Pretested Fescue Palatability

Certain plants were improved by crossing, according to a taste panel of cattle

■ Cattle have been used in Kentucky to sort out plants from which promising fescue grasses have been bred. Several of these experimental tall fescues rate high in palatability and a few fairly high in vigor.

Tall fescue is important largely because of its wide range of adaptability to climates and soils and its productivity. Its slight unpalatability, however, is a rather serious drawback. And there's some question of its nutrient value.

Despite their large size, cattle were successfully used to test-graze a collection of individual fescue plants as well as several breeding lines. In all tests, cattle ate certain plants readily, others reluctantly, if at all. Rabbits and other small animals are customarily used in palatability studies, but these fescues were tested with animals which are to use the forage. The findings should be more reliable.

Agronomists R. C. Buckner, of ARS, and E. N. Fergus, of the Kentucky Agricultural Experiment Station, developed the promising fescues from a local naturalized strain G1–25 found in eastern Kentucky, and from two closely grazed plants in a field of Kentucky 31 tall fescue.

Some 2,750 plants of the G1–25 strain were transplanted in a nursery at Lexington and periodically grazed free choice. Each time, the plants were rated for vigor (chiefly height and diameter) and were grazed until one clone or line was cropped closely. The preference of the cattle for various plants was then judged by how closely they were grazed.

Plant collection was narrowed

After 2 years, the experimental collection was narrowed to the 28 most palatable plants—5 that were preferred at 4 grazings per year and 23 plants preferred at 3 grazings. And the two Kentucky 31 clones were added. These 30 plants and their progeny were inbred and tested for several generations, using only the most palatable plants to continue each line. In three generations, the researchers had gone about as far as they could in improving palatability through inbreeding.

Plants of the eight most palatable selfed lines of the strain G1–25 of tall fescue were then arranged in different combinations and planted in isolated polycross nurseries to intercross and produce seed. Equal amounts of seed from the eight lines were then bulked and planted to produce a synthetic variety. More restricted synthetics were similarly made by combinations from just certain ones of the eight lines, and in one case from the seeds of just one highly palatable and relatively vigorous inbred line designated as 45–50. Seed from the first synthetic generation (Syn. 1) was grown out to produce a second generation (Syn. 2).

The select inbreds and new synthetics were increased, plot-grown, and tested for several years for vigor, yield, and grazing preference in comparison with standard varieties and naturalized strains Kentucky 31, Alta, Goar, and G1–25.

Cattle chose progeny of 45–50

The inbred progeny from plant 45–50—one of the original Kentucky 31 selections—has consistently had the highest grazing preference. Palatability was improved through three generations of inbreeding, and the palatability of other lines notably improved by crossing with 45–50.

Inbred line 45–50 was about as vigorous as Kentucky 31 in spaced-plant nurseries but was low-yielding in sod. It had the poorest vigor rating and lowest yields (an average of 3,747 pounds of dry matter per acre in the third and fourth generations) of the nine fescues plot-tested for agronomic character. Representative plantings of Kentucky 31 yielded 4,679 pounds of dry matter per acre, and the relatively unpalatable natu-

ralized strains G1–32 and G1–43 yielded 4,645 and 5,171 pounds respectively.

The first and second generations of Buckner's synthetic variety built from progeny of the eight most palatable inbreds toperossed onto line 45–50 are as vigorous as Kentucky 31. Synthetics are not significantly different from Kentucky 31 in yield and comparable to 45–50 in palatability.

Even though one of the new tall fescues should get a superior rating for beef production—better than Kentucky 31—the search will continue for even better combinations of palatability and productivity.

Wide palatability range shown

The Kentucky study has shown that commercial varieties contain plants having a wide range of palatability. The study also has shown that unpalatable but otherwise desirable varieties can be rather quickly improved by crossing with palatable strains. Inbreds differ, however, in ability to transmit palatability. The inbred 45–50 has a pronounced ability to do this. The original clone of that line is being maintained and doubtless will be used in future breeding, unless the scientists find more desirable clones that also have this ready transfer ability.

One of the problems in palatability studies is the lack of understanding of the factors which contribute to palatability. The studies showed that lines low in fiber were significantly more palatable. One other factor is suggested but not proved. When cattle are turned into the spaced-plant nurseries and sod plots, they range over the plants with muzzle close to the ground, passing some grasses and promptly grazing others. This suggests an aroma factor.

All the new tall fescue strains are still experimental and not available to growers.☆

Five New Potato Varieties Released

■ Development of good-eating, high-yielding, disease-resistant potatoes reached a new high last year with release of four new varieties under the cooperative USDA-State National Potato Breeding Program. A fifth variety was released in Mexico jointly by USDA and the Rockefeller Foundation.

Catoosa, developed and tested by ARS and the Tennessee and Louisiana experiment stations, is the first red-skinned potato that has some resistance to both late blight and scab. It is superior to Pontiac in culinary qualities and compares favorably in yielding ability with standard varieties when grown in Alabama, Florida, Louisiana, Tennessee, and Texas.

Redskin was developed by ARS and released jointly with the Texas Agricultural Experiment Station. It yields as high or higher than standard varieties grown in most States, especially those in Maine, Pennsylvania, Delaware, Iowa, Florida, and Texas. It is resistant to scab and net necrosis due to leafroll.

Blanca and Navajo, sister varieties developed at Greeley, Colo., by ARS and released cooperatively with the Colorado experiment station, are good baking potatoes and make good chips either before or after storing. Blanca is highly resistant to scab; Navajo has good resistance, producing less scab-infected tubers with fewer lesions than susceptible varieties grown in the same location. Both Blanca and Navajo were outstanding in yield and quality in tests in Colorado.

A U.S. breeding selection screened for resistance to late blight in Mexico was named variety Erendira there after proving to be field resistant to the many races of the fungus that occur in Mexico. It is being used as a parent in ARS breeding work.

Erendira will be most useful to small farmers who grow potatoes as a basic food crop in the Mexican highlands. In experiments in Central Mexico, Erendira produced good to excellent yields without protective fungicides in fields where local or imported varieties either were killed by blight or yielded nothing.☆

A. Snow collects on open ground but in forest is intercepted by tree crowns and disappears. B. Organic matter from hardwood litter mixes with soil to depths of 12 inches or more, making it water permeable. C. Pine needle litter shows little mixture with soil.

FORESTS . . . the type of trees and how they're managed . . . have great bearing on

WATER RUNOFF

■ The kinds of trees growing in northern forests affect water flow and storage by influencing the thickness of the snow blanket and the depth and intensity of soil freezing, USDA foresters find.

If soil freezing is severe enough to form concrete frost—when mineral soil particles freeze into a solid mass—water cannot penetrate and runs off, contributing to spring floods and low water supplies in summer.

Deep snow insulates the soil from frost. Snow is deeper under trees with bare branches and young pines with open spaces between trees than under dense stands. Pines intercept snow on their needled branches, from where it evaporates or blows off.

Humus formed from hardwood litter mixes with mineral soil. This mixture freezes in granular or honeycomb form permeable to water, so melting snow and rain penetrate soil and replenish ground-water tables. The humus layer under pines, on the other hand, does not mix with mineral soil and the soil freezes deeply and solidly. Further, shade from dense crowns retards melting of snow and frost.

Forester W. D. Striffler measured concrete frost depth under different forest types in Michigan. A dense red pine plantation had as much as 11 inches; open pine (open spaces between trees) in the same area had 2.5 inches; and bare-branched oaks and northern hardwoods had only 1.5 inches of solid frost.

The same relationships were observed near Cass Lake, Minn., by forester R. R. Bay. Concrete frost penetrated more than 10 inches in red pine and remained through most of April. In aspen brush, concrete frost did not go below 6.7 inches and disappeared early in April.☆

A superior new alfalfa

A new alfalfa, Utah Synthetic C, which produces high seed yields and good hay that is not stemmy or coarse, is being developed by USDA scientists at Logan, Utah.

According to ARS agronomist M. W. Pedersen, this experimental variety is equal to Ranger alfalfa in quality and hay production—and produces about 30 percent more seed. Ranger is the most widely planted alfalfa in the Midwest and comprises about 30 percent of all U.S. plantings.

Utah Synthetic C was developed through systematic intercrossing and selection begun in 1950 with cooperation of the Utah Agricultural Experiment Station. From this, Pedersen and coworkers obtained five clonal lines that were combined to produce the new experimental variety.

The researchers are investigating the possibility that bees help increase seed production of Utah Synthetic C because they like it better than most other varieties and pollinate it more readily.

Scientists at Logan are also trying to breed resistance to the spotted alfalfa aphid and stem nematode into Utah Synthetic C. However, more research and testing are needed before it will be released.

All out against witchweed

Chemical weedkillers and cultural practices are being used in this year's witchweed eradication effort in North and South Carolina. All land known to be infested—about 117,000 acres on 6,094 farms—is treated.

Long-range eradication efforts against witchweed, a destructive parasite of corn and other crops, started in 1953. Work is conducted by plant pest control workers of USDA, research and regulatory agencies of the two infested States, and farmers.

A new preplanting herbicide—2,3,6-trichlorophenylacetic acid—is being used on more than 5,000 acres. In last year's tests this chemical gave effective, full-season control of witchweed in corn without injury to the crop. Scientists suggest more study of the chemical before it can be recommended for general use.

About 98,000 acres will be treated with the herbicide 2,4-D, and some 12,500 acres will be under cultural treatment this year.

Injury may be reduced

Cracking or splitting of sweet cherries may be reduced or even prevented in some cases, according to State-USDA research.

Studies by agricultural engineers of ARS and the Michigan Agricultural Experiment Station showed this can be done by: (1) reducing water absorption; (2) increasing transpiration rate (moisture loss) and decreasing expansion of cherry cells; and (3) increasing skin strength.

The researchers base their conclusions on results obtained in tests in a weather chamber. Cherries were exposed to various extremes of temperature, humidity, rainfall, and airflow to determine the extent of injury caused by each.

They found that moisture absorption during rainfall is largely responsible for cracking or splitting. The cherries absorb water through the skin and from roots and leaves.

Air movement was found to increase moisture loss from the cherries and, if high enough, to prevent cracking altogether. The possibility of flying over orchards with an airplane or helicopter to dry the fruit and decrease cracking was suggested.

Also suggested was the use of orchard heaters to heat the air to increase transpiration. This would bring the air temperature above the fruit temperature and would also help dry the leaves and trees, important because water may move from the leaves into the cherries.

Results of the tests also indicated the usefulness of certain chemical sprays to increase the skin strength and thus prevent splitting.

Considerable future work is suggested on use of controlled airflow to prevent cracking under field conditions, space heaters in orchards, chemical sprays on cherries before and after rainfall, and on the effects of these sprays on moisture movement and skin toughness. Also suggested are studies of moisture movement into the cherry through the tree and skin, and on the respiration rate of cherries in sugar solution.

Land values rise again

Total market value of farm real estate rose to $129.1 billion as of March 1, 1960, $4 billion above a year ago. USDA agricultural economists place value at $111.46 per acre, 3 percent higher than 1959. Advances of 6 to 8 percent a year occurred in 1956, 1957, and 1958.

The slowdown in the increase of values was most pronounced in the Corn Belt, Lake States, and Northern Plains. Values in these States averaged only 1 or 2 percent higher than a year earlier. The market value of

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farm buildings remained about the same as a year ago, but was a slightly smaller proportion of the total value of land and buildings.

Few farm foreclosures

Farm real estate mortgage foreclosures continue to be rare, according to USDA agricultural economists.

Foreclosures at the rate of 1.6 per 1,000 farms (in the year ended last March 15) were the same as a year earlier and close to the record low of 1.0 per 1,000 in 1947. Distress transfers dropped to an estimated 6,500, down 100 from the 1959 estimate. Court-directed foreclosures were probably fewer than 1,000.

In all, about 190,000 land tracts and farms changed hands at a rate (47.1 per 1,000 farms) slightly less

than a year earlier. The trend has been downward since 1946–47, except for two short periods during the Korean War and in 1954–55.

Most transfers are voluntary, and the current rate of these is 30.7 per 1,000 farms—2 percent below the 1958–59 rate and the lowest since 1939–40. This lower rate of transfer, combined with a 2-percent decline in number of farms, reduced the estimated total of voluntary transfers to about 124,000, or less than half the annual number for 1943–48.

Little change took place in rates of other types of farm transfers in the year ended last March 15. Sales for delinquent taxes numbered 0.6 per 1,000 farms, compared with 0.4 per 1,000 in 1958–59. Administrator and executor sales were up slightly from 1958–59, but transfers by inheritance and gift remained about the same. The combined rate for all methods of transfer other than voluntary was 14.2 per 1,000 farms, compared with 14.8 the previous year.

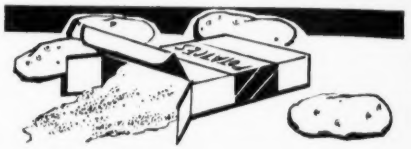
Improved method success

An improved method of manufacturing potato granules—used in making some instant mashed potatoes—has been successfully laboratory tested by USDA scientists at the Western utilization division in Albany, Calif.

The time-consuming addition of already dried granules to cooked potatoes in the initial drying stage has been eliminated. ARS food technologists found that this "add-back" is not essential to high quality.

New techniques reported to industry include cooking at low temperature (185° to 190° F.), conditioning sliced potatoes before cooking by soaking in water at low temperature, and partial drying and granulation in new-type equipment. Peeling, slicing, and final drying remain unchanged.

Slow cooking apparently tends to produce in potato starch an open structure that is maintained through processing. This open structure also increases the moisture absorbing capacity of the final product. Slow cooking and conditioning before



cooking improve texture when granules are reconstituted.

Properly conditioned cooked potatoes can enter the drying system directly, making add-back unnecessary.

In the new granulating-drying equipment, rotating blades gently disintegrate the cooked potatoes on a moving belt or in a trough as a warm air current removes moisture. The blades have a mild compressing and shearing action essential to drying.

A drum-dryer reduces moisture to 55 percent. After conditioning at room temperature or lower, the granulator dryer reduces moisture to 35 percent. Final drying is done in a fluidized-bed dryer.

Arboretum addition open

Fern Valley, a new section at USDA's National Arboretum, Washington, D.C., was dedicated and officially opened in May.

The area contains 60 varieties of ferns native to the eastern United States and 85 types of native trees, shrubs, and wild flowers.

Fern Valley was cosponsored by the National Capitol Garden Club League and the American Fern Society.

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